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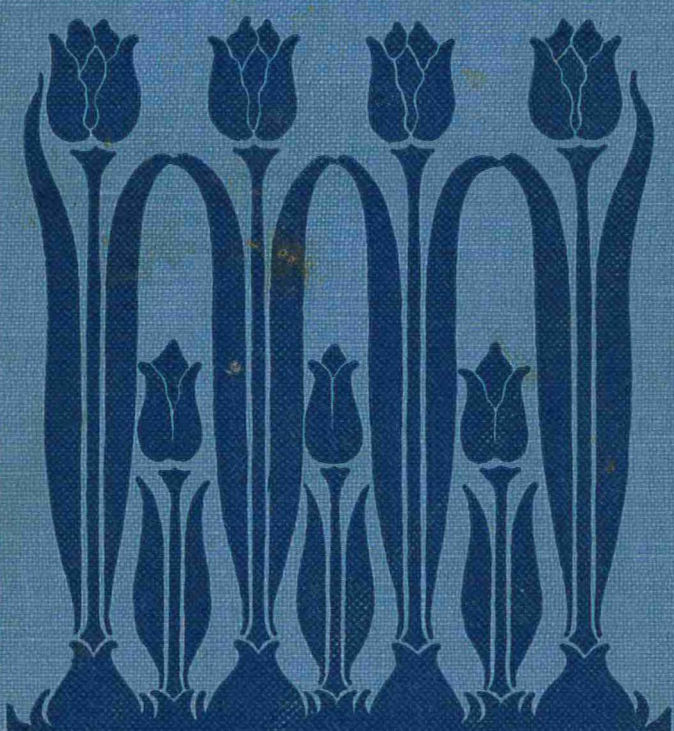
Story of the Aeroplane

BY C. B. GALBREATH



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INSTRUCTOR LITERATURE SERIES

Story of the Aeroplane

BY

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Story of the Aeroplane

The Aeroplane

The Ocean of Air

Around the dry land of the earth are the oceans of water. We may never have seen them, but we have knowledge of them and their navigation, and their names suggest very definite and concrete objects of thought. We sometimes do not realize, however, that we live and move and have our being at the bottom of a vaster and deeper ocean that covers to a depth of many miles the whole earth, and to the surface of which man nor beast nor bird has ever ascended; an ocean with currents and whirlpools and waves of more than mountain height; an ocean in which we are as much at home as are the finny tribes and the monsters of the deep in their watery caverns. This is the ocean of the air. We are about to consider man's efforts to rise from the bottom of this ocean and wing his flight a little way through the atmosphere above him. His excursions upward are limited, for he could not live near the surface heights of this ocean, vast and deep and boundless. The art and science of his flight through the air, because of its relation to the flight of birds, we call aviation. (*Avis:* Latin, a bird.)

Early Attempts at Aviation

"The birds can fly and why can't I?"

This query of Darius Green, in various forms, has suggested itself to man since the dawn of history. Born with an inspiration to look upward and aspire, the navigation of the air has appealed with peculiar force to his imagination and through the centuries has at different times led bold and adventurous spirits to attempt what the world long regarded as impossible. The heavens seemed reserved for winged insects, birds and angels. Audacious man might not venture out upon the impalpable air. Can man fly? After more than four thousand years it was left for man to answer yes, to rise from the earth on wing and thrill the world "with the audacity of his design and the miracle of its execution." Bold enterprise! Fitting achievement to usher in a new century! A seeming miracle at first, but destined soon to excite no more curiosity than the flight of bees and birds. The solution of the problem of human flight was no miracle nor was it the swift work of genius accomplished at a magic master stroke. It was the result of intelligence and industry patiently applied for years till the barriers of difficulty gave way and man ventured out with assurance on the highways of the air.

Just when he first attempted to fly is not known. Ancient Greek mythology abounds in stories of flying gods and mortals. Kites which bear some relation to the aeroplane were toys among the Chinese thousands of years ago. A Greek by the name of Achytes is reported to have made a wooden dove which flew under the propelling power of heated air. Baldad, a tribal king in what is now England, so tradition has it, attempted to fly over a city but fell and broke a leg. A similar accident is said to have happened to a Benedic-

tine monk in the eleventh century and to others attempting like exploits in after years. A fall and a broken leg seem to have been the usual results of these early attempts at aerial flight.

In the fifteenth century students and inventors gave serious attention to the navigation of the air and trustworthy accounts of their labors come down to us. Jean Baptiste Dante, a brother of the great Italian poet, made a number of gliding flights from high elevations and while giving an exhibition at a marriage feast in Perugia, like his predecessors in the middle ages, alighted on a roof and broke a leg. Leonardo da Vinci, the great painter and sculptor, was an amateur aviator of no mean attainment for his day. He invented a machine which the operator was to fly by using his arms and legs to set wings into flapping motion, like those of birds. This was called an orthopter, or ornithopter, a name which may be properly applied to any similar device. Another machine invented by him was in the form of a horizontal screw ninety-six feet in diameter. By the twisting of this the machine was designed to fly upward. This was called a helicopter. Da Vinci's third invention in this line was the parachute, with which successful descents were made from towers and other elevations. In the early half of the eighteenth century the Swedish philosopher, Emanuel Swedenborg, sketched in one of his works a flying machine of the orthopter style which he knew would not fly but which he suggested as a start, saying "It seems easier to talk of such a machine than to put it into actuality, for it requires greater force and less weight than exists in the human body."

In 1742 the Marquis di Bacqueville at the age of sixty-two attempted to make a gliding flight from the tower of his home in Paris across the river Seine to the gar-

dens of the Tuileries, started successfully in the presence of a great multitude, but suddenly halted over the river and fell into a boat, paying the historic penalty of a broken leg.

At this point it may be well to classify the flying devices thus far considered.

Early Flying Machines

1. The *orthopters*, or as they are less commonly called, the ornithopters. The word "orthopter" means straight wing and the word "ornithopter" bird wing. This class of machines includes those designed to fly by the flapping of wings, somewhat in imitation of birds.

2. The *helicopters*. The word "helicopter" means spiral wing. Flying machines of this class are designed to fly by the rapid horizontal rotation of two spiral propellers moving in opposite directions but so shaped that their combined effect is to move the machine upward. They are like a pair of tractor propellers of the modern aeroplane but arranged horizontally to lift the machine instead of drawing it forward in a vertical position.

3. The *gliders*. As the name suggests, these were designed to coast or glide down the air, to start from a high elevation and by sailing through the air in an oblique direction reach a lower elevation at some distance from the starting point. Down to the latter part of the nineteenth century only the gliders were successfully used in man flight. In reality they can scarcely be called flying machines for they could not lift their own weight, though late experiments prove that when once in air they may rise above their starting point under the influence of a strong wind. The glider, however, performed a most important part in the evolution of the aeroplane. In coasting the air from hills, sand

dunes and towers against steady wind currents a number of inventors through a series of years learned how to guide and control these gliders in their downward flight,—an essential preparation for the application of motive power to lift the glider against the force of gravity and thus make it a veritable flying machine or aeroplane.

Nineteenth Century Experiments

In the early part of the last century an Englishman, Sir George Cayley, made many experiments with gliders and tabulated with great care the results of his investigations. He concluded, like Swedenborg, that man has not the power to fly by his own strength through any wing-flapping device, or orthopter, but he intimated that with a lighter and more powerful engine than had then been invented a plane like those used in his gliders, if slightly inclined upward, might be made gradually to ascend through the air. The results of his experiments he published in 1810. They clearly foreshadowed the triumph that came almost a century later.

In 1844 two British inventors, Henson and Stringfellow, working out the suggestions of Cayley, made an aeroplane model equipped with a steam engine which is said to have made a flight of forty yards—the first real upward flight of a heavier than air machine on record. This model was a monoplane, that is, the lifting surface was a single plane like the outstretched wings of a bird. Twenty-two years later experiments were made with a biplane, that is, an aeroplane with two lifting planes or surfaces, one above the other.

Claims of Maxim and Ader

While others had made flying models, Sir Hiram Maxim in England constructed a multiplane, driven by a powerful steam engine over a track and rising at one time, as he declares, a few inches from the ground. He claims that his was the first machine to "lift man off the ground by its own power." This test was made in 1889.

Clement Ader, a Frenchman, also claims this honor, saying that he was the first to make a machine that would rise and lift a passenger. On October 9, 1890, his friends say he made a short forward flight of 150 feet in a monoplane propelled by a forty horse power steam engine. In 1897 he claims to have made a number of secret flights, but a little later, in a test before officers of the French army who had become interested in the invention, the machine turned over and was wrecked. The support of the army for further experiments was withdrawn and Ader in despair abandoned the problem of aerial navigation which had claimed long years of study and unremitting effort. He stopped just short of the goal "with success almost within his grasp."

Langley's Tandem Monoplane

About this time two Americans, Samuel Pierpont Langley, of the Smithsonian Institution, and Octave Chanute were conducting along scientific lines a series of experiments in aviation. On May 6, 1896, a steam-propelled model was started in a flight over the Potomac River. Dr. Alexander Graham Bell, the inventor of the telephone, who was present, declared that after a flight of eighty to one hundred feet the machine "settled down so softly that it touched the water without the

least shock and was in fact immediately ready for a second trial." Other experiments were tried with success.

Langley's first machine was a tandem monoplane, that is, it had two pairs of wings, one immediately following the other. The engine and the propellers were between the two pairs of wings. In later models he used the biplane construction.

Finally the United States government appropriated $50,000 to build a machine that would carry a passenger. In constructing this, Langley equipped it with a gasoline engine of about three horse power. The machine was comparatively light, weighing all told only fifty-eight pounds. On August 8, 1903, a public test was made "without a pilot," on the Potomac River near Washington. Spectators and reporters congratulated the inventor on the success of the experiment, while he with modest satisfaction said, "This is the first time in history, so far as I know, that a successful flight of a mechanically sustained flying machine has been made in public." This statement was no doubt true of machines of any considerable size, but as we shall presently see, toy flying machines of the *helicopter* type had long ere this been exhibited to the wondering gaze of boys who were ultimately to bring to a practical conclusion man's long line of effort to rise triumphant and shape his course through the ocean of air.

Langley's machine had flown without a pilot. A little later the inventor announced himself ready for the final test. Like his first model, his machine was a tandem monoplane. Its weight with pilot was 830 pounds and its plane or wing surface was 1040 square feet. It was fifty-two feet long and its arched wings measured forty-eight feet from tip to tip. The gasoline motor with which it was equipped developed fifty-two horse power and with all accessories weighed about 250 pounds.

At Widewater, Virginia, September 7, 1903, the machine was tested. On a barge it was carried out into the Potomac River, with Charles M. Manley, Professor Langley's assistant, who was to pilot it in its first flight. The moment for the supreme test arrived. A mechanical device on the barge shot the machine and pilot into the air. To the disappointment and dismay of the spectators, the machine plunged front downward into the water. It was rescued with the young pilot unharmed. Another attempt was made to launch it in the air with a similar result, except that this time it dropped into the water rear end downward. The government gave the project no further encouragement, and the query ascribed to Darius Green remained unanswered. Professor Langley died a few years afterward, his life shortened, it is believed, through the blighting of the hope that he had long entertained to be the first successfully to navigate the air.

Experiments with Gliders

Through the latter part of the last century experiments were carried on with gliders. Among those who achieved much success in this field was the German, Otto Lilienthal, the "flying man," who made remarkable glides in the early nineties. He would run along the crest of a hill, jump from a precipitous declivity and sail on the wings of his glider over the valley below, guiding his course up and down and from side to side with a rudder attached to the machine. It was his idea that the problem of aviation was to be solved by perfecting the glider so that it could be controlled in its downward flight and then adding a propelling power that would sustain it and lift it through the air.

After the death of Lilienthal by accident in 1896,

others continued experiments along similar lines with the same purpose in view. Among these were Octave Chanute and A. M. Herring. They tried at first a monoplane glider and afterward one of five planes. This number they reduced to two. The rudder was made of movable horizontal and vertical blades. It was found that the glider with two planes, the biplane, was most satisfactory.

Herring made for this a compressed air engine and claimed that with this he accomplished a flight of seventy-three feet. There is some doubt, however, as to this claim and some question as to whether it was an upward flight or a downward glide.

Aviation at the Beginning of the Present Century

As briefly outlined here, such was the status of aviation at the beginning of the new century. Much progress had been made and substantial vantage ground had been gained, but the problem still awaited practical solution. At this point it may be well to consider some of the features of the problem and the devices thus far evolved by long years of investigation and experiment.

The Kite

One of the simplest forms of the aeroplane is the common kite. This takes various forms. It is usually made of a framework of three light strips of wood crossing a little above the center and secured at the outer ends by similar strips, or strong cord tautly drawn and making when covered with paper a six-sided figure. From the corners of the framework cords are drawn to a common point near the center and there firmly united. At this point of union is attached the twine which is held in the

hand of the kite flyer. From the base of the kite is suspended a string with light horizontal paper rolls, each about the size of a lead pencil, tied at intervals of a few inches, and forming the tail which steadies the kite in air. The paper surface of the kite is the plane on which the pressure of the air current and the power applied to the string is to lift the kite upward. As this simple form of the kite has but one plane, it may be considered a monoplane. The box kite presents two such surfaces joined together at the sides by the ends of the "box," and may therefore be called a biplane.

When the boy flies his kite he first determines the direction of the wind and runs in that direction. In other words he flies his kite against the wind. The pressure of the moving current against the under surface keeps the kite aloft. When the boy runs against the wind, moving the kite forward with him, this pressure is increased and the kite tends to rise higher and higher. If instead of the long string and the boy there could be placed with the kite itself a very light motor that would give to it the same forward impulse, the kite would float through the air without boy or string and we would have a small aeroplane flying machine—a monoplane. If there were two kites, with parallel surfaces a few inches apart, united with light framework so that the air would pass between them, we should have a biplane. For many years the great problem in aviation was to get an engine of sufficient lightness and power to propel monoplanes, biplanes and multiplanes at an upward angle through the air.

The "Plane" Defined

It may not be out of place here to consider what constitutes a plane, as that term is used in aviation. It is that part of the aeroplane, the pressure of the air upon the surface of which lifts and sustains the aeroplane aloft. The plane may take a variety of forms; it may be curved or its parts may meet in an angle; it may be uniform and unbroken in shape or divided into parts. The two wings of a bird would constitute a monoplane, when they are in a horizontal position for soaring, or when the tips are uplifted and they form an angle like a broad V, called a dihedral angle. If the aeroplane has two such planes, one back of the other, it is still called a monoplane, or, more definitely, a tandem monoplane; but if one of the planes is above the other it is called a biplane. A similar arrangement of three planes, one above the other, could be called a triplane and one of several planes a multiplane.

Essentials of the Aeroplane

The Planes, as already described are, of course, a necessary part of the aeroplane.

The propeller supplies motive power to the aeroplane. This moves in a circle much like the blades of the electric fan or the propeller of a motor boat or modern stern ship. By driving the air backward it propels the aeroplane forward. While the blades of the propeller are of considerable length they are usually inconspicuous in photographs, and as one who has never seen an aeroplane looks at a photograph he naturally asks, "What moves it through the air?" The propeller is driven by the engine.

The engine is usually of the gasoline type which develops high power with light weight, frequently one

horse power for every three pounds of weight and in rare instances as high as one horse power for every pound of weight. These powerful little engines are marvels of mechanism and they have had much to do in the rapid modern progress of aeronautics.

The rudder, as its name indicates, guides the aeroplane in its flight. It consists in the main of small horizontal and vertical planes under the control of the pilot. These may be in the front of the machine, but they are usually placed in the rear. By skillful manipulation of these the aeroplane can be guided upward, downward, to right or left at will. It is also guided and controlled as we shall see, by the "warping" or "curving" of the wings or planes.

The Wright Brothers and Their Problem

The dawn of the twentieth century was to immortalize new names in the annals of aviation. In the city of Dayton, Ohio, two brothers in a modest way were conducting a bicycle repair shop. From youth they had been inseparable in their aims and work. They were the sons of Bishop Milton Wright of the United Brethren Church. They had each a high school education but had not attended college. In 1878, when they were boys of seven and eleven years respectively, their father brought them one evening a little flying toy, a small helicopter, the motive power of which was furnished by a rubber band wound around the shafts of two propellers so as to drive them, when "wound up" and released, in opposite directions. The toy was made of light material to resemble a bird. When the father released it in the presence of the wondering boys, to their astonishment it flew upward in the room, rose to the ceiling and after fluttering there for a little while fell to the floor. They

did not concern themselves much about the name of the toy, but properly called it what to their minds it most closely resembled—"the bat." They afterward made other toys like it and discovered that as they were increased in size they flew less successfully. They early developed a fondness for kite flying and in this were regarded as experts. When they grew to manhood, however, they abandoned these boyish sports and devoted themselves industriously to their machine and repair shop. "The bat" and the kite became memories, but the memories of youth have power to shape the thoughts of manhood, and this early observation and experience with aerial toys gave to Wilbur and Orville Wright an interest in the attempts at aviation that were chronicled in the press from time to time through the decade immediately preceding this new century.

In the year 1896 Orville, the younger of the two brothers, was convalescing from a serious attack of typhoid fever. Wilbur, who had been carefully attending him, was one day reading aloud an account of the death of Otto Lilienthal, the German aviator, who was killed while experimenting with his glider. The details of the tragic accident, together with an account of what he had accomplished by years of investigation and experiment, interested the brothers, who resolved as soon as possible to apply themselves to the construction of a glider in which flights could be made with comparative safety. The enthusiasm of Orville over the project ran so high that it almost caused a return of the fever. As soon as he had fully recovered, the two brothers returned to their bicycle shop and applied themselves with increasing zeal to the study of aeronautics, and after a time began the construction of a glider.

The Wright brothers were peculiarly well equipped for the work upon which they had entered. They were

men of unflagging industry, abstemious habits, few words and the happy faculty of keeping their own counsel. Wilbur was unusually reticent. It is said of him that he spoke only when he had something to say and then in a manner singularly brief and direct. "He had an unlimited capacity for hard work, nerves of steel and the kind of daring that makes the aviator face death with pleasure every minute of the time he is in the air." Orville, while much like his brother, is more talkative and approachable. Both were modest and unassuming when they began their work and continued so when the world applauded their achievements.

In the study of the problem upon the solution of which they ventured, they had of course the advantage of all that had thus far been achieved by those who had preceded them in this field of investigation and experiment. Professor Langley had already perfected his first monoplane to such an extent that short flights were successfully made with a light steam-propelled model. He was continuing his experiments and the Wright brothers read with avidity the results of his work. Every scrap of information that they could gather from others who had essayed the solution of the problem was now collected and made the subject of critical study. At first taking up aeronautics merely as a sport, they soon afterward with zest began its more serious pursuit. "We reluctantly entered upon the scientific side of it," they said, "but we soon found the work so fascinating that we were drawn into it deeper and deeper."

In their efforts to construct a practical flying machine they adopted the plan of Lilienthal and Chanute. They sought to construct a machine which they could control and in which they could make glides with safety. This they built in the form of a biplane glider and with it they experimented industriously for years. The suc-

cessful construction of the machine required a high degree of skill. The length and width of the planes, their distance apart, the materials to be used, the shape, size and position of the rudder and numerous other details were to be worked out only by patient study and frequent tests. They were now in the field of original experiment and soon found that they had to reject as useless many theories that had been carefully elaborated by scholarly writers.

The brothers soon learned that a long narrow plane in a position nearly horizontal, moved in a direction at right angles to one of its lateral edges and inclined or "tipped" slightly upward would develop greater lifting power than a square or circular plane. This discovery was not indeed original with them, but their experiments confirmed the conclusions of their predecessors.

The surface shape of the plane is an important consideration. It has been found that a slight upward arch from beneath, making the under surface concave, gives the best results. The concavity should reach its maximum about one-third of the distance from the front or entering edge to the rear edge of the plane and should be the same whether one or more planes are used. In flight the forward or entering edges of the planes are tipped slightly upward to give the machine lifting power for the same reason that the top of a kite is given an angle of elevation so that the air will lift it as it is drawn forward by the string.

Balancing the Machine

The balancing of a machine in mid-air is one of the most difficult problems in aviation. In the balloon this is easily accomplished because the principal weight, the basket with the passenger, is below the gas-filled sphere

or compartment, and the balloon tends to right itself after any disturbance by the wind, much like a plummet when swayed out of its position.

Professor Langley, Lilienthal and others had sought to take advantage of this tendency in the construction of their machines by placing or arching the wings above the pilot or heavier portion of the mechanism. After a slight disturbance in mid-air the machine would then tend to right or balance itself and assume its former position. The practical difficulty of this arrangement, however, arose from the fact that when once set to swaying the gliders thus constructed continued to sway like the pendulum of a clock. The Wright brothers set themselves the task of finding some other method of preventing the biplane from dipping downward or upward at either side with the shifting of air currents. The first device to give steadiness of motion was a small movable horizontal plane, supported parallel with and in front of the two main planes, and by means of a lever, under control of the pilot.

At Kitty Hawk

Having after much study completed their glider, the Wright brothers sought a suitable place for their first tests. By correspondence with the United States Weather Bureau they learned that at Kitty Hawk, North Carolina, the winds are stronger and more constant than at any other point in the United States. This treeless waste of sand dunes along the solitary shore near the village afforded the privacy where they might carry on their work unmolested. Here in October, 1900, they spent their vacation testing their biplane glider. They sought to fly it in the face of the wind like a kite. This they succeeded in doing but it would not support the

weight of a man. They then experimented with it, using light ropes from below to work the levers and guide it through the air. It was sufficiently responsive to encourage them and they went back home to make at their leisure a number of improvements.

The year following they returned to the same place with a larger machine considerably improved, but it still failed to lift the operator. Octave Chanute, of Chicago, with whom they had been in correspondence, came to witness their tests and examine their glider. They now decided to abandon much of the "scientific data" which they had collected from the writings of others and proceeded in the light of their own experience. They coasted down the air from the tops of sand dunes and tested with satisfaction their devices for guiding their air craft. In 1902, with additional improvements, they made almost one thousand gliding flights, some of which carried them a little over six hundred feet, more than twice the distance attained the previous year. All this time their object had been to control the machine while in air. Only after this was accomplished did they propose to add motive power to keep it above the earth. They wisely reasoned that it would be useless to apply this power to a machine that could not be directed and controlled.

The First Flight

The Wrights had now reached a point where they felt that they were ready to apply motive power, rise like a bird from the earth and direct their course through the air. A new machine was built with two planes, each six feet six inches wide and measuring forty feet from tip to tip. The planes were arranged one directly above the other with an intervening space of six feet. An

elevating rudder of two horizontal planes ten feet in front of the machine, and a rudder of two vertical planes about six feet long and one foot apart in the rear of the machine were under control by levers close to the hands of the pilot, who, prostrate on the lower large plane, directed the course up or down, to the right or left at will. But the most remarkable features of all were the gasoline engine that was to give motive power and the propellers by which that power was to move the machine in its flight through the air. The mechanism, the result of patient study and arduous labor, had been perfected in the little shop at Dayton and had been brought to the barren sand coast of North Carolina for its first practical test. The engine, which developed sixteen horse power, was connected by chains with the two propellers, each eight feet in diameter at the rear of the biplane. The total weight was 750 pounds.

To give the machine a "start" it was driven rapidly along an iron rail by a cable attached to a weight of one ton suspended at the top of a derrick. When everything was at last in readiness, the engine was started, the propellers were set in rapid motion, the weight at the top of the derrick was released, the biplane was driven rapidly forward, and lo! bearing a man, it skimmed over the sand dunes! It continued only eleven seconds but landed without injury to pilot or machine. A small beginning indeed, but it proved the practicability of man flight and ushered in the era of aviation. A few days earlier in the same month on the banks of the Potomac a crowd of witnesses saw with keen disappointment the failure of Professor Langley's flying machine, and as they turned away said mentally and not a few of them audibly, "Impracticable!" "It can't be done." On the sand near Kitty Hawk, in the presence only of the inventors and five others, life

savers and fishermen from Kill Devil Hill Station near by, fortune rewarded two brothers unknown to the world and they achieved what had long been regarded as impracticable and impossible. Professor Langley worked long and patiently on his models and was very properly given $50,000 by the government to aid in an enterprise that was to give man dominion of the air. The Wright brothers with the same faith and unflagging zeal worked secretly in their little shop at Dayton without financial assistance and out of their small earnings conducted experiments on the Carolina coast, doing their own cooking to lighten expenses, and solved the problem that had thwarted the inventive genius of the world. No crowds, appreciating the significance of the event, were present to applaud, nor did the brothers exult over the achievement. It was indeed only what they had confidently expected.

On the day of their initial success two other flights of slightly longer duration were made. The fourth flight continued fifty-nine seconds, almost a minute, and extended over a distance of 853 feet. The machine was then carried back to camp. In an unguarded moment it was caught by a gust of wind, rolled violently over the ground and was partially wrecked. But what mattered the loss? For the "first time in the history of the world a machine carrying a man had raised itself by its own power into the air in free flight, had sailed forward on a level course without reduction of speed and had landed without being wrecked.

Machine Balanced by Warping of Planes

The Wrights found one of the greatest difficulties to be overcome was the balancing of their machine. This was only measurably and unsatisfactorily accomplished

by the horizontal rudder. They began to study the flight of soaring birds for a solution of the difficulty. They found that the hawk, the eagle and the gull maintained a horizontal position by a slight, almost imperceptible upward or downward bending of the extreme tips of their wings. They then began experiments with slightly flexible planes that could be bent or warped at will by the pilot. This was one of their most important and original contributions to the problem of aviation, and it gave the pilot in a marked degree control of his machine. The scientific arching of the planes to give them the maximum lifting effect was also the result of their investigations.

They now removed the field of experiment to Hoffman Prairie near Dayton where at first they met with indifferent success. They invited friends and reporters from their home city to witness a flight, but the machine acted badly in the presence of company. While the spectators were not favorably impressed the inventors were in no wise discouraged. Their perseverance was later rewarded in 1904 by a flight of three miles in five minutes and twenty-seven seconds. The year following a flight of 24.20 miles was made in thirty-eight minutes, thirteen seconds, at heights of seventy-five to one hundred feet. These attracted small attention. The inventors fully satisfied with their success and working industriously to perfect their machine were also safeguarding the results of their labors by carefully patenting every device that helped them to the goal of practical aviation. While Europe was applauding the achievements of the intrepid and wealthy Brazilian, Santos-Dumont, who made public flights near Paris, the world was practically unaware of the greater achievements of the Wright brothers a year earlier. Newspaper accounts of their flights were received with a degree of incredu-

lity, but the indifference of the public was favorable to the modest brothers who with tireless energy and slender means triumphed over difficulty after difficulty as they moved toward the larger success that they ardently desired and the fame that they sought not.

Newspaper Reports Verified

In 1907 the United States Government asked for bids for a flying machine that would carry two men, remain in the air an hour and make a cross country flight of forty miles an hour. The Wright brothers entered into a contract to build such a machine. This fact and rumors of their success that reached the large cities from time to time led a party of newspaper reporters to organize themselves into a spying party to trace the Wrights to their secret retreat and verify the claims made in their behalf or publish the deception to the public. After a long and tedious journey from Norfolk they finally sighted the rude hut of these birdmen. They then secreted themselves until they were rewarded with evidence that the reports were true and promptly announced to the world that these quiet men had actually solved the problem of aerial flight.

Trial Flights at Fort Meyer

In 1908 Orville Wright began trial flights at Fort Meyer preliminary to the tests required by the government contracts. A record flight was made in June. The morning was still and beautiful; the leaves hung motionless on the great plane trees of Washington as Orville Wright and August Post, Secretary of the Aero Club of America left the city about six o'clock and proceeded by way of Georgetown to Fort Meyer where trial

flights were to be made with the biplane. It was taken from its shed and placed on the starting rail. The weights were lifted into position, the engine started, the propellers set in rapid motion and all was in readiness for starting. Only a few persons were in sight, including a squad of soldiers who were cleaning the guns of a field battery. Mr. Wright took his place on the machine. At a signal the weights were released, it was drawn forward, and rising gracefully at the end of the rail gradually ascended in a circuitous course upward. Mr. Post kept time and marked circuits on the back of an envelope. Round and round went the machine, rising higher and higher. After a little the spectators realized that a record flight was in progress. Ten—twenty minutes passed. Higher and higher circled the aeroplane. Now it has been aloft on wing for half an hour! The spectators stand rigid and look upward. Mr. Taylor, chief mechanic, in almost breathless interest exclaims, "Don't make a motion. If you do he'll come down."

In the city word had reached the newspaper reporters that Mr. Wright had gone out for a flight. "Does he intend to fly today?" came the question over the telephone. "Yes, he is in the air now and has been flying for more than half an hour," was the answer.

Then came the rush for fuller details and the results of the record-making trial were flashed over the country and cabled under the seas to distant lands. Senators, congressmen, departmental officials and representatives of every walk of life in the national capital were a little later on their way to witness another exhibition of the wonderful flying machine. Mr. Wright in the afternoon made another world's record, remaining in the air an hour and seven minutes. In the evening with Lieutenant Lahm at his side he performed without accident

the greatest two-man flight ever made. These achievements awed and thrilled the great throng of spectators who greeted the triumphant conclusion of each with tumultuous cheers. The problem of the centuries had been solved. The "impossible" had been accomplished! The dream of the visionaries had become a reality!

Fatal Accident

On the 17th of September occurred a sad accident that brought to a close for the year the preliminary tests that had been carried on thus far with marked success. When Orville Wright and Lieutenant Selfridge were flying at a height of about seventy-five feet, one of the propellers struck a stray wire which coiled around and broke the blade. This precipitated the machine earthward and fatally injured Lieutenant Selfridge who died three hours afterward. Orville narrowly escaped the same fate with a number of broken bones. Aviation at this time was attended with great dangers and the daring spirits who ventured aloft on the wings of the wind were in constant peril of their lives.

Wilbur Wright Wins Fame in France

Meanwhile Wilbur Wright who had gone to France was making a series of record flights. Early in the month of August near Le Mans he flew fifty-two miles and was in the air one hour and thirty-one minutes. A few days later he broke the previous record for altitude, attaining an elevation of 380 feet. On the 31st day of December he won 20,000 francs for the longest flight of the year. His modest bearing, simple habits and wonderful achievements called forth great praise from the impressionable French. When he took up his quarters

at Le Mans he arranged to prepare his own meals as he had previously done on the coast of North Carolina, but the French would not hear to this and furnished him a cook. In speaking of this incident afterward Wilbur Wright said in a jocular way: "Not knowing enough French to dismiss him or find out who sent him, I permitted him to remain."

In January, 1909, Orville Wright, who had recovered from his injuries, joined his brother at Pau, France. Here they gave many exhibition flights that were witnessed by the great scientists and the nobility of Europe. Here their feats were witnessed by the King of England and the King of Spain who personally extended hearty congratulations. Wilbur took his machine to Rome where King Emanuel attended his exhibition flights. Later the two brothers were the guests, in London, of the Aeronautical Society of Great Britain and received its gold medal. Their bearing and achievements abroad gave them world-wide fame.

Wright Brothers Honored

Arriving in Washington June 10th, they received a medal at the hands of President Taft from the Aero Club of America. Continuing their journey homeward, they were met at Xenia, Ohio, by a delegation from Dayton. They at once began to inquire about their fellow townsmen.

"Look here, Wilbur," said one of the committee, "you'll see all those folks at the station in a few moments."

"Why, who is at the station?" asked Wright.

"Oh, twenty-five or thirty of the boys" was the reply.

As they entered their home city they saw the streets thronged with people.

"I see the twenty-five or thirty," remarked Mr. Wright, "but I thought you folks knew better than this."

Later they were honored in their home city with a two-day celebration, at the climax of which medals were presented to them from Congress, from the State of Ohio and from the city of Dayton. Their fame was world-wide and at last their own city had "discovered" them and welcomed them with enthusiastic pride.

United States Government Requirements Successfully Met

Soon afterward they returned to Fort Meyer to continue their work preparatory to the final tests. They had entered into a contract with the United States Government which was to pay $25,000 for a machine which would carry two men one hour in a circuitous course and perform a cross-country flight of ten miles at the rate of forty miles an hour. On the day of the final tests the people of Washington came forth in greater crowds than ever before. Officialdom, including representatives of foreign embassies, army officers, newspaper correspondents and civilians, were present to witness the crucial test. Among the spectators was Miss Katherine Wright, the scholarly sister of the two brothers, who had followed with deep and sympathetic interest every step in the progress of her brothers up to this hour.

At a signal, Orville Wright, with Lieutenant Lahm again at his side started on his time-test flight. Upward in spiral course they rose. At length the hour limit was passed and a mighty cheer from the multitude announced the result. Still the machine with its two passengers remained aloft. Nine minutes more passed. The world's record made by Wilbur Wright was broken.

Wilbur, who was present, announced the result by waving a handkerchief and calling aloud, "Give him a cheer, boys." Soon after this the machine gently descended, having been in the air an hour, twelve minutes and forty seconds, the longest two passenger flight that had been made to that date.

Orville Wright was soon overwhelmed with congratulations. Coming forward President Taft said:"

"I am glad to congratulate you on your achievement. You came down as gracefully and as much like a bird as you went up. I hope your passenger behaved himself and did not talk to the motorman. It was a wonderful performance. I would not have missed it."

The President then shook hands with Wilbur, saying,

"Your brother has broken your record."

"Yes," replied Wilbur, with a smile, "but it's all in the family."

On August 30, came the speed trial over a course from Ft. Meyer to Alexandria five miles distant. This at that time was considered the most difficult test of all. The course was over a broken and uneven country, valleys, ravines, hills, forests and open fields alternating. Lieutenant Benjamin D. Foulois was chosen to accompany Orville Wright on this perilous trip. The machine arose and circled between the two flags that marked the starting line, and amid cheers of the spectators started on its flight toward the two captive balloons that marked the limit of the course. Smaller and smaller it grew in the distance as it was swayed slightly out of its path by the wind. It at length turned the goal on the hill at Alexandria. On the return it was borne downward until it disappeared. Would it rise again or would it be swept down by a treacherous current and wrecked in the valley? After a moment's suspense it again appeared in clearer outline over the treetops. Nearer and

nearer it came until in the midst of waving handkerchiefs and thunderous cheers, it softly alighted near its starting place. The daring aviator was heartily congratulated again by the President and other eminent men who thronged about him. His sister told him that the glad news had already been telegraphed to his aged father in Dayton. The machine had successfully met all requirements and had made in the cross country flight 42.6 miles an hour, entitling the brothers in addition to the $25,000 to a bonus of $5,000, making in all $30,000. Wonderful as was this record at the time, succeeding flights with improved machines now make it seem trivial and commonplace.

Later in the year 1909 Orville Wright went back to Europe where he achieved distinction in a number of flights while Wilbur remained at home to participate in the Hudson-Fulton celebration and thrill his countrymen by encircling in a flight the statue of liberty and returning to his starting point on Governor's Island.

It is not necessary to follow further the aeronautic achievements of the Wright brothers. While they were the first to construct a successful aeroplane, inventors in America and abroad quickly followed them and machines of various forms and construction but based on the same principle were soon making record flights in many lands. The simultaneous development of the aeroplane in the United States and Europe is explained by the fact that the progress of the experiments of the Wright Brothers was promptly reported and eagerly noted on the other side of the Atlantic. Octave Chanute immediately after his visit to Kitty Hawk made a trip abroad and gave a detailed account of what the Wright brothers had accomplished. This account with drawings was published and European inventors had this information on which to work. In 1909 Louis Bleriot,

a French aviator, who had sprung into prominence the preceding year, crossed the English Channel in his beautiful birdlike monoplane. In 1910 George Chauz, flying upward 7,000 feet, crossed the Alps amid the treacherous and frozen winds of the snow-capped peaks only to meet a tragic death as he neared the goal in sunny Italy. Equally daring and dangerous was the trip of the brilliant American aviator Glenn Curtis in his biplane from Albany to New York City, followed a few days later by the notable achievement of Charles K. Hamilton who in a machine of the same make flew from New York City to Philadelphia at the average speed of fifty and one-half miles an hour. Aviation meets and record breaking flights in this country and Europe now followed in such rapid succession that the long list would only weary the reader. In this rapid and spectacular progress that gave man dominion over the air and the power to surpass the eagle's flight it is interesting to note how well the Wrights kept in the forefront of the era that they ushered in. Frequent changes have greatly improved the efficiency of their machine. In 1910 it made the then greatest altitude flight, reaching a height of 11,476 feet. In 1911 C. P. Rodgers, in successive stages, flew in one of their biplanes from New York City to Long Branch, California, a distance of 4,029 miles, with actual flying time of 3 days, 10 hours, 4 minutes.

Recent Improvements

Improvements are still in rapid progress. The hydroaeroplane has been invented. This is a slightly modified aeroplane with equipment that will keep it afloat on the water, from which it may rise and fly at the will of the pilot. Aviators have developed high skill in the

control of their machines in mid-air. They have at high speed described intricate figures, sustained themselves in inverted positions, and performed the dangerous and thrilling feat of "looping the loop" in their swift downward flight. Swifter than flight of bird and outspeeding the winged tempest, man has cleft the highways of the air. A long line of fatal accidents has marked his progress, but with reckless and audacious courage he has kept his course until he has added the "upper deep" to the realm of his dominion.

The leading nations of the world have equipped their armies with flying machines from which it is possible to spy out the position of the enemy, carry messages across besieging lines and drop explosives in the midst of hostile fortifications, What effect this will have on the future of war can only be conjectured. If by making war more terrible, or by rendering useless the vast armaments and defences, it shall serve to end all wars, then would the vision of the poet Tennyson be indeed realized:

"For I dipped into the future, far as human eye could see,
Saw the Vision of the world, and all the wonder that would be;

"Saw the heavens fill with commerce, argosies of magic sails,
Pilots of the purple twilight, dropping down with costly bales;

"Heard the heavens fill with shouting, and there rained a ghastly dew
From the nations' airy navies grappling in the central blue;

"Far along the world-wide whisper of the south wind rushing warm,
With the standards of the peoples plunging through the thunder-storm;

"Till the war-drum throbbed no longer, and the battle-flags were furled
In the Parliament of man, the Federation of the world."

Later Developments of the Aeroplane

1911 Jan. 18. E. Ely, in a Curtiss biplane, flew from the aviation field near San Francisco to the deck of the Cruiser Pennsylvania, in San Francisco Bay, and returned to the field. The first time such a feat had been accomplished.

1911 May 22. P. Vedrines flew from Paris to Madrid, 386 miles, crossing the Pyrenees at 7,000 feet altitude.

1911 Sept. 24. The aviator Widmer flew across the Adriatic from Venice to Trieste, in 1 hr. 15 min.

1911 The speed record was 82.72 miles.

1912 During the Italo-Turkish and Greco-Turkish wars, aeroplanes flew over forts and encampments, taking sketches and sending information by wireless.

1912 May 30. Wilbur Wright died.

1912 July 13. J. Vedrines, at Pau, France, made a speed of 106.11 miles per hour; and non-stop distance record of 447.01 mi.

1914 With the opening of the European War, aeroplanes were commandeered by governments, and extensively used for scouting, bomb dropping, carrying messages, photographing, and wireless information.

1914 Jan. 2. Orville Wright, at Dayton, Ohio, demonstrated his automatic stabilizer for aeroplanes.

1916 April 12. H. G. Hawker, at Brooklands, Eng., attained an altitude of 24,408 feet.

June 20. Lieut. A. Marchal made a record non-stop flight of 812 miles, from Nancy, France, to Chlom, Poland.

August 25. Victor Carlstrom, carrying a passenger, made a record flight for duration, at Newport News, Va., 661 miles, in 8 hrs. 40 minutes.

November 19. Ruth Law, American, made a non-stop flight of 590 miles, from Chicago to Hornell, N. Y., in 5 hrs. 45 minutes.

November 20. Ruth Law completed her journey to New York City, 294 miles, in 3 hrs. 10 min. 35 sec. Total distance 884 miles. Time, 8 hrs., 55 min., 35 sec.

1917 The war development of the aeroplane, both for scouting and fighting, has been phenomenal. They are used to photograph enemy intrenchments, the information being utilized to locate batteries for artillery attack. They are used as "spotters" for hits during bombardments, and direct assaults. They carry a machine gun, and engage in duels at elevations of a mile or two. The control of the air has proved an advantage almost decisive, and deeds of audacious gallantry are daily performed on every side to secure or maintain that control.

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